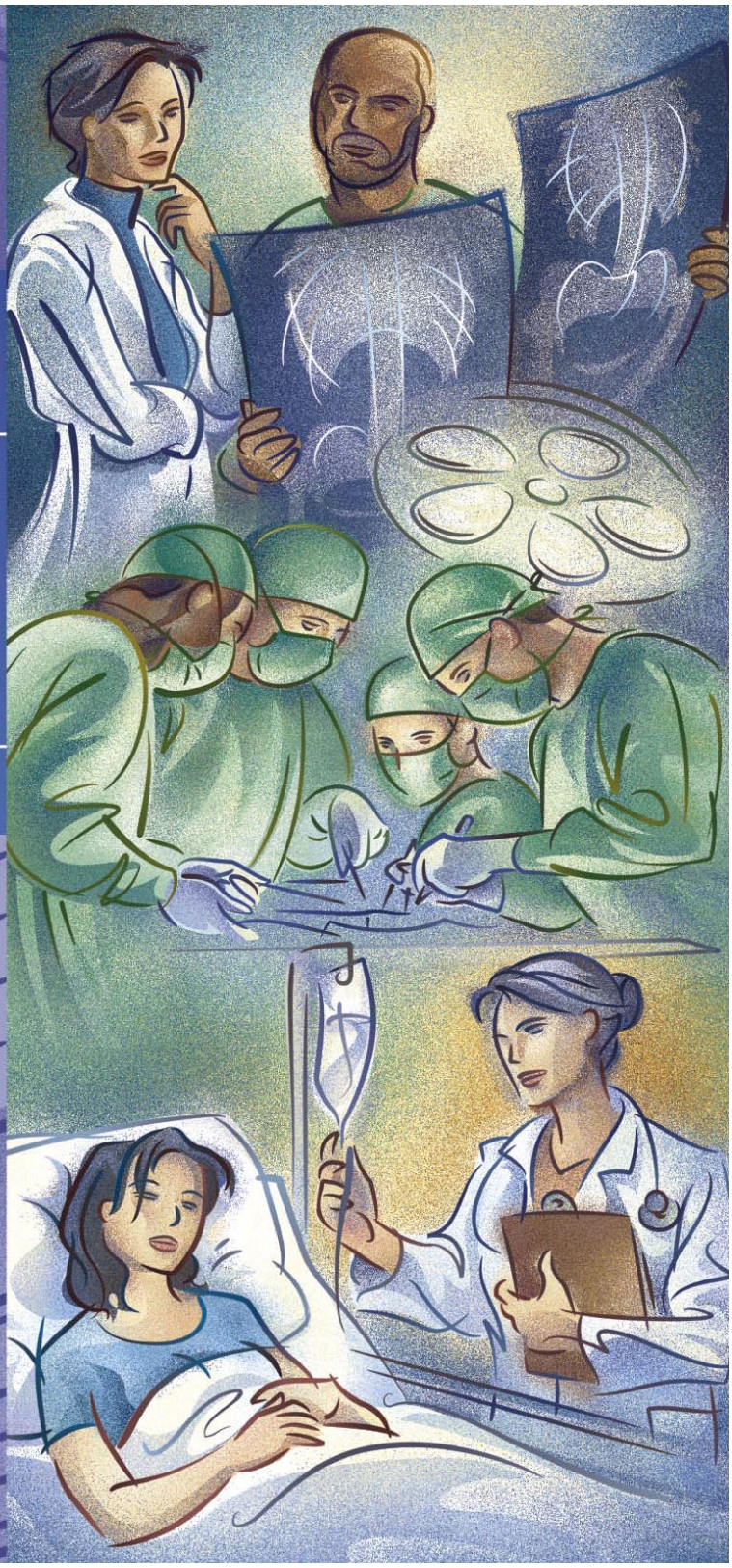
AHRQ

AHRQ QUALITY INDICATORS

Inpatient Quality Indicators

SOFTWARE DOCUMENTATION



AHRQ Quality Indicators

Inpatient Quality Indicators: Software Documentation, Version 2.1 SPSS

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Agency for Healthcare Research and Quality
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Abstract

The value of information on health care quality has never been so widely recognized; yet many organizations lack the resources and/or expertise to build a quality information program from the ground up. Recognizing this, the AHRQ Quality Indicators were developed specifically to meet the short-term needs for information on health care quality using standardized, user-friendly methods and existing sources of data.

This module of the AHRQ Quality Indicators was designed to capitalize on the availability of administrative data on inpatient stays to produce information for Inpatient Quality Indicators (IQIs). These measures include:

- ***volume*** of certain intensive, high-technology, or highly complex procedures for which evidence suggests that institutions performing more of these procedures may have better outcomes;
- ***mortality*** for inpatient procedures and for inpatient conditions; and
- ***utilization*** indicators which examine procedures whose use varies significantly across hospitals and for which questions have been raised about overuse, underuse, or misuse.

This document is the software documentation for the Inpatient Quality Indicators software Version 2.1, which is provided on the AHRQ Web site. The software was developed in SPSS, for use on a personal computer. By making this tool available, we hope to assist others in producing information on health care quality more cost effectively.

Details on the development of the Inpatient Quality Indicators can be found in "Guide to Inpatient Quality Indicators: Quality of Care in Hospitals - Volume, Mortality, and Utilization."

Acknowledgments

This product is based on the work of many individuals who contributed to its development and testing.

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AHRQ Quality Indicators, Software Documentation, Version 2.1: Inpatient Quality Indicators

Introduction

This documentation describes the software for implementing the Inpatient Quality Indicator (IQI) module of the AHRQ Quality Indicators Version 2.1 and highlights features of the analytic approach of particular interest to new users. Detailed information about the Inpatient Quality Indicators (IQI) is contained in the companion document "*Guide to Inpatient Quality Indicators,"* which includes information about the development of the indicators and their definitions.

The software consists of a series of computer programs that:

- Assign and calculate IQIs from hospital discharge abstracts or UB (uniform billing) claims data.
- Print IQI results in SPSS format that can be imported into word processing documents, spreadsheets, or graphics software, at the user's option.
- Create risk-adjusted rates that adjust for casemix differences.
- Create smoothed rates that reduce fluctuations over time due to random variation.

This documentation includes:

- A discussion of the data elements necessary to produce the AHRQ IQIs and the uniform coding conventions recommended for those elements.
- Descriptions of the IQI processing steps in nontechnical language.
- Detailed descriptions of the functions of each IQI SPSS program.

Critical user information is highlighted with this symbol:

Components of the Inpatient Quality Indicators module

As shown in Table 3 on page 10, the Inpatient Quality Indicators module consists of five SPSS programs and 17 ASCII text files that contain auxiliary data. These programs and text files are described in the subsequent sections of this document. The programs were developed for use in Statistical Package for the Social Sciences (SPSS), version 7 or higher, on an IBM compatible computer.

A note on the naming conventions for the Inpatient Quality Indicators (IQI) module programs. Most programs have names of the form IQSPSi, IQSPSAi, or IQSPSPi. The first two characters "IQ" of the program name indicates an Inpatient Quality Indicators program, to distinguish it from other modules that have been or will be released from AHRQ. The next three characters of the program name are "SPS" and are present to distinguish the program from the SAS versions of the software. In the programs that are specific to either Area or Provider runs, the sixth character of the program name is either "A" or "P". The sixth character is an "A" if is for the production of Area indicator rates that use county and Metropolitan Statistical Area (MSA) area populations as denominators. The sixth character is a "P" if it is a program that is for the production of Provider indicator rates that use subsets of the hospitalized population. The last character (i) of the variable name designates the number of the specific program.

Quick Reference

The subsequent four pages are intended to serve as a quick reference to assist in reading this documentation and in reviewing the Inpatient Quality Indicator (IQI) module outputs. Processing steps (Figures 1 and 2) are shown first followed by a listing of the module variables (Table 1), variable prefixes (Table 2), and module contents (Table 3). One suggestion is to print these pages in duplex mode on two sheets of paper so that they can then be easily referred to as the need arises.

Figure 1. Processing Steps for the Inpatient Quality <u>Provider</u> Indicators

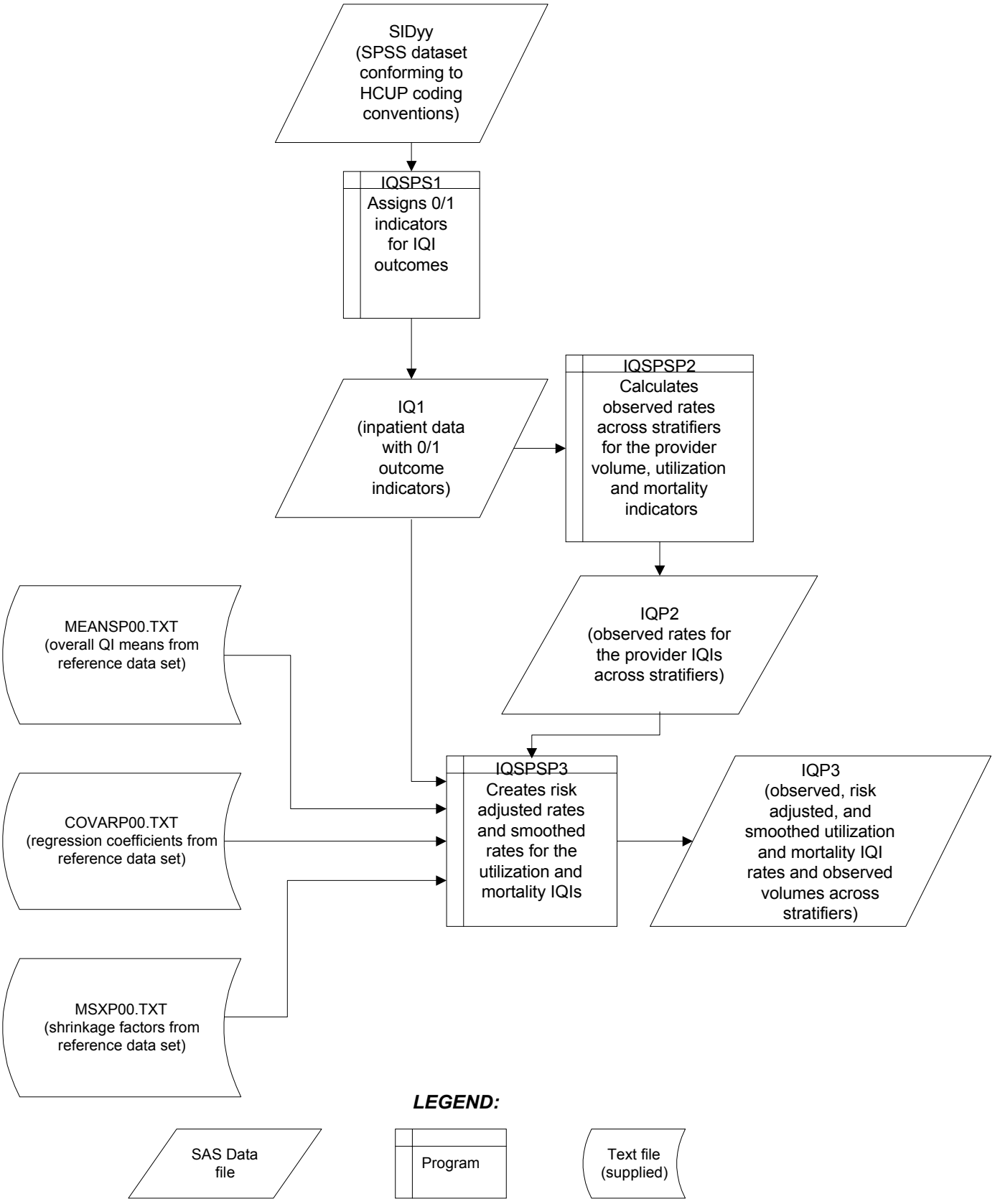
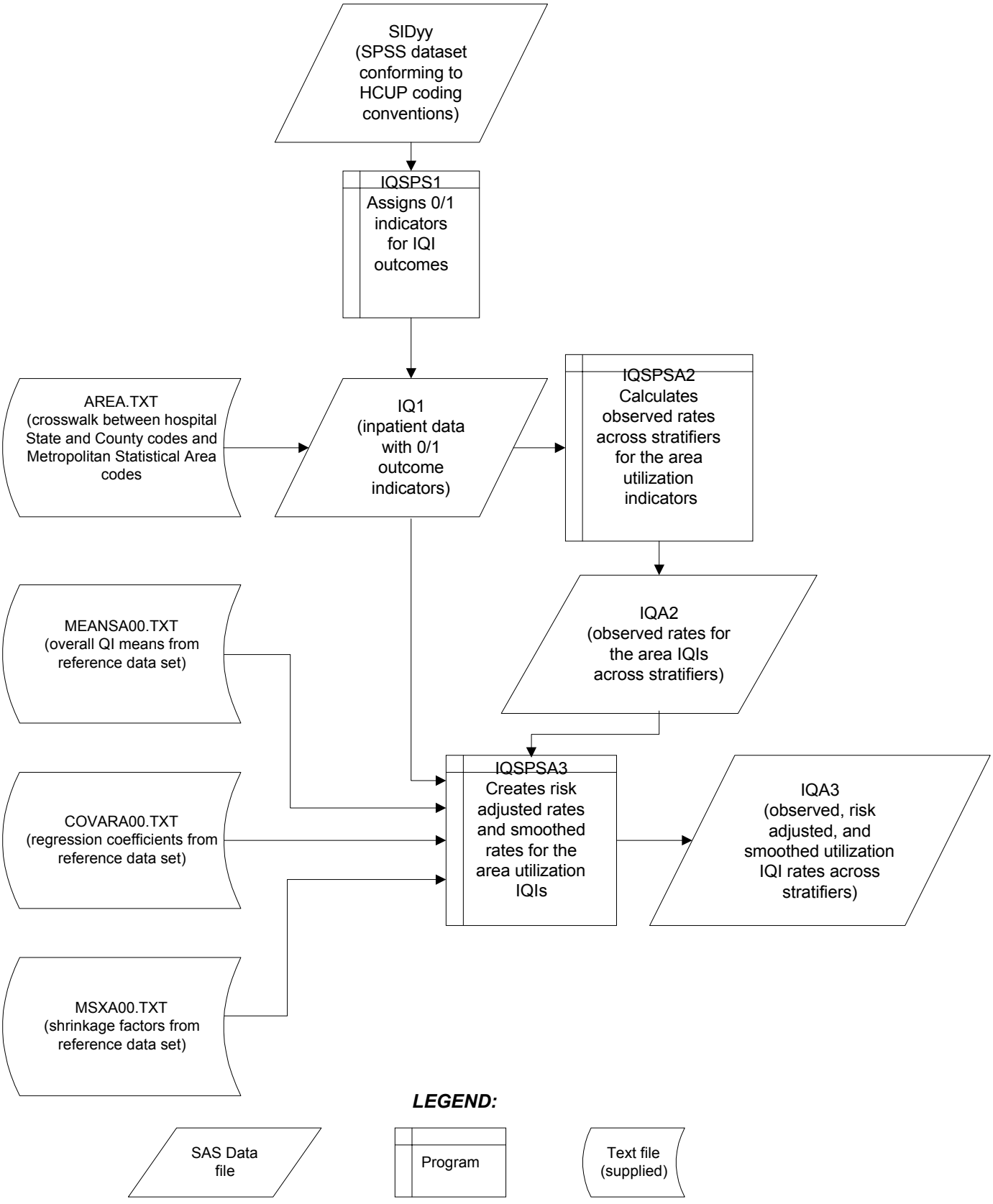


Figure 2. Processing Steps for the Inpatient Quality <u>Area</u> Indicators



Inpatient Quality Indicator Module Details

Table 1. Inpatient Quality Indicator (IQI) Variables

type		IQI number	Indicator	Age categories 0 to 17	18 to 39	40 to 64	65 +
Provider	Volumes	1	Esophageal resection				
		2	Pancreatic resection				
		3	Pediatric heart surgery		No	No	No
		4	AAA repair				
		5	CABG	No	No		
		6	PTCA[a]	No	No		
		7	Carotid endarterectomy				
	Post-procedural mortality Rates	8	Esophageal resection				
		9	Pancreatic resection				
		10	Pediatric heart surgery		No	No	No
		11	AAA repair				
		12	CABG	No	No		
		30	*PTCA[b]*	No	No		
		31	*Carotid endarterectomy[b]*				
		13	Craniotomy	No			
		14	Hip replacement				
	In-Hospital Mortality rates	15	AMI	No			
		16	CHF	No			
		17	Stroke	No			
		18	GI hemorrhage	No			
		19	Hip fracture	No			
		20	Pneumonia	No			
	Utilization rates	21	Cesarean section				
		22	VBAC (Vaginal Birth After C-section)				
		23	Laparoscopic Cholecystectomy				
		24	Incidental appendectomy among elderly	No	No	No	
		25	Bi-lateral cardiac catheterization				
Area	Utilization rates	26	CABG	No	No		
		27	PTCA	No	No		
		28	Hysterectomy	No			
		29	Laminectomy	No			

[a] PTCA = percutaneous transluminal coronary angioplasty
[b] PTCA and carotid endarterectomy mortality are not recommended as stand-alone indicators, but are suggested as companion measures to the corresponding volume measures.

Table 2. Prefixes for the Inpatient Quality Indicator (IQI) Variables			
Prefix	**Contents**	**EXAMPLES**	
		Provider indicator # 8, Esophageal resection	**Area indicator # 26, CABG utilization**
T	Inpatient numerator (top)	TPIQ08	TAIQ26
P	Population denominator (pop)	PPIQ08	PAIQ26
O	Observed Rate (not applicable to IQI01-IQI07)	OPIQ08	OAIQ26
R	Risk-adjusted Rate (not applicable to IQI01-IQI07)	RPIQ08	RAIQ26
S	Smoothed Rate (not applicable to IQI01-IQI07)	SPIQ08	SAIQ26

Table 3. Inpatient Quality Module Contents	
SPS programs	**ASCII text files †**
IQSPS1.SPS	AREA.TXT
IQSPSP2.SPS	QIPOP97.TXT
IQSPSP3.SPS	QIPOP98.TXT
IQSPSA2.SPS	QIPOP99.TXT
IQSPSA3.SPS	QIPOP00.TXT
	QIPOP01.TXT
	QIPOP**A**97.TXT
	QIPOP**A**98.TXT
	QIPOP**A**99.TXT
	QIPOP**A**00.TXT
	QIPOP**A**01.TXT
	MEANSP00.TXT
	COVARP00.TXT
	MEANSA00.TXT
	COVARA00.TXT
	MSXP_00.TXT
	MSXA_00.TXT

† The ASCII text files are data files provided with the Inpatient Quality module and are necessary for the programs to run. There is no need to convert these files to SPSS format for use with the software.

Background

The Inpatient Quality Indicator module contains 29 indicators that reflect the quality of care inside hospitals. (Two additional mortality indicators – indicators 30 and 31 – are computed by the software but are recommended to be used only with the corresponding volume measures.) These indicators serve as flags for potential quality problems rather than definitive measures of quality of care. The indicators include three groups of measures based on hospital stays.

1. There are seven **Volume** indicators for inpatient procedures for which there is evidence that a higher volume of procedures is associated with lower mortality. A nontrivial number of these procedures are performed by institutions that do not meet recommended volume thresholds. Information about these thresholds and their sources in the literature are given in the interpretation section on page 37. The volume indicators are measured as counts of admissions in which particular procedures were performed.

2. There are 13 Inpatient **Mortality** indicators for medical conditions and surgical procedures that have been shown to have mortality rates that vary substantially across institutions and for which evidence suggests that high mortality may be associated with deficiencies in the quality of care. These indicators are measured as rates, the number of deaths divided by the number of admissions for the procedure or condition. (Two additional mortality indicators – 30. PTCA and 31. carotid endarterectomy – are computed but are recommended to be used only with the corresponding volume measures.)

   Nine of these mortality indicators are for procedures, seven of which are also measured by a volume indicator.

   The other six mortality indicators are associated with medical conditions, most of which (except for GI bleeding and pneumonia) are highly concentrated on older patients 50 years of age or older. Hip fracture is more common among elderly women.

3. There are nine **Utilization** indicators for procedures for which there are questions of overuse, underuse, or misuse. The procedures being examined are ones whose use varies significantly across hospitals and areas, and for which high or low rates of use are likely to represent inappropriate or inefficient delivery of care, leading to worse outcomes, higher costs, or both. These indicators are measured as rates, such as # of C-sections per births in a hospital, # of laparoscopic cholecystectomy per admissions with cholecystectomy.

   Five of the utilization indicators are rates based on the hospitalized population. Four other utilization indicators are rates based on an area's residential population. Two of these area utilization indicators (for CABG and PTCA) have counterparts in the set of volume indicators.

   For the four area-based utilization indicators, geographic areas are defined at the MSA (Metropolitan Statistical Area) level for urban areas and at the county level for rural areas.

The indicators in the IQI module are listed in Table 1 on page 9. See also Appendix A of the "*Guide to Inpatient Quality Indicators"* for the definition of each indicator.

The data required for measuring these indicators come from hospital discharge abstracts or billing claims (administrative data) which are readily available in many states. The residential population data for the four area-based utilization indicators are from the Bureau of Census.

The software generates observed, risk-adjusted, and smoothed rates for all but the volume indicators. Observed rates are the raw rates. Risk-adjusted rates are derived from applying the average casemix of a baseline file that reflects a large proportion of the U.S. hospitalized or residential population. Smoothed rates are estimates with removal of fluctuations over time due to random variation.

For information about how these indicators were identified, see the "*Guide to the Inpatient Quality Indicators."*

Data elements and coding conventions

Input for the AHRQ Quality Indicators

The IQI software was written to process data from discharge data abstracts that contain information about hospital stays. The specific data elements that are needed for the IQI software are listed in Table 4. The IQI module was tested on data from the Healthcare Cost and Utilization Project (HCUP). HCUP is an ongoing Federal-State-private collaboration to build uniform databases from administrative hospital-based data collected by State data organizations and hospital associations.

The input data files for the Inpatient Quality Indicators software must be in SPSS.

For ease of use, the input data file should contain a specific set of variables coded in specific ways. For example, the IQI software expects a numeric data element named SEX with values coded 1 for male and 2 for female.

We recommend that users recode data elements in their input files to be consistent with the coding expected by the software. This will minimize the number of internal changes that will be necessary in the Inpatient Quality Indicators software.

For example, recoding the SEX data element in the input file to be consistent with the coding described above is easier than modifying all uses of the SEX data element in the IQI programs.

Input data elements, their characteristics, and values expected by the software are described in Table 4. Not every value for every data element is referenced by the IQI software. For example, disposition (DISP) values are used only to identify transfers and deaths. However, we include the complete set of HCUP values to assist users of the uniform HCUP data files.

To minimize internal changes to the software, all required elements should be present in the input data file. If a required element is not available, a dummy element should be provided. Failure to provide a dummy element will result in errors during the execution of the IQI programs.

Table 4. Data Elements and Coding Conventions

Variable name	Description	Format	Value description	Comments
AGE	Age in years at admission	Numeric	Age in years	If missing, excluded from the analysis.
RACE	Race of patient.	Numeric 1 2 3 4 5 6	White Black Hispanic Asian or Pacific Island Native American Other	The values of 1,2,3 are used directly in the QI software. All other ethnicity codes are mapped to an 'other' category.
SEX	Sex of patient	Numeric 1 2	Male Female	If missing, excluded from the analysis.
PAY1	Expected primary payer	Numeric 1 2 3 4 5 6	Medicare Medicaid Private, incl. HMO Self-pay No charge Other	The values of 1,2,3,4 are used directly in the QI software. All other payer codes are mapped to an 'other' category. Used to stratify only the Provider-level IQIs (IQI01-IQI25).
HOSPSTCO	Hospital location (FIPS† State/county code)	Numeric ssccc	Modified Federal Information Processing Standards State/county code	Available at: http://www.census.gov/population/estimates/county/
HOSPID	Data Source hospital number	Numeric	Hospital identification number	
DISP	Disposition of patient	Numeric 1 2 3 4 5 6 7 20	Routine Short-term hospital Skilled nursing facility Intermediate care Another type of facility Home health care Against medical advice Died in the hospital	The values 2 and 20 are referenced by the QI code (to identify transfers to another short-term hospital, and patients who died in the hospital).
APR_DRG	APR-DRG category	Numeric	APR-DRG from 3M software.	This is an optional but recommended variable that can be obtained by first running the input discharge dataset through version 15 of the APR-DRG software (3M Corporation). If users do not have the APR-DRG variables, they should leave off this and the other APR-DRG variables from the input dataset and specify **!let !apr = 'none' .** on Program P3.
SEVERTY	APR-DRG Severity Score	Numeric	APR-DRG Severity Score from 3M software.	This is an optional but recommended variable that can be obtained by first running the input discharge dataset through version 15

				of the APR-DRG software (3M Corporation). If users do not have the APR-DRG variables, they should leave off this and the other APR-DRG variables from the input dataset and specify **!let !apr = 'none' .** on Program P3.
RISKMORT	APR-DRG Mortality Score	Numeric	APR-DRG Risk of Mortality Score from 3M Software.	This is an optional but recommended variable that can be obtained by first running the input discharge dataset through version 15 of the APR-DRG software (3M Corporation). If users do not have the APR-DRG variables, they should leave off this and the other APR-DRG variables from the input dataset and specify **!let !apr = 'none' .** on Program P3.
DRG	Diagnosis Related Group	Numeric	DRG from federal DRG Grouper	
MDC	Major Diagnostic Category	Numeric	MDC from federal DRG grouper	
NDX	Number of nonmissing diagnosis codes used on each discharge record	Numeric	Counts principal and all secondary diagnoses	
NPR	Number of nonmissing procedure codes used on each discharge record	Numeric	Counts principal and all secondary procedures	
DX1 – DX30	Diagnoses ICD-9-CM codes. DX1 is the principal diagnosis, DX2-DX30 are secondary diagnoses.	String, 5 character each	Diagnoses variable names on the input dataset	These must be specified as an array from the first DX variable to the last DX variable. Users with more or fewer secondary diagnoses should modify this list as well as the !MAXDX parameter on Program 1.
PR1 – PR30	Procedure ICD-9-CM codes. PR1 is the principal diagnosis, PR2-PR30 are secondary procedures.	String, 4 character each	Procedure variable names on the input dataset	These must be specified as an array from the first PR variable to the last PR variable. Users with more or fewer secondary procedures should modify this list as well as the !MAXPR parameter on Program 1.

†Federal Information Processing Standard, as defined by the U.S. Department of Commerce, National Institute of Standards and Technology (formerly National Bureau of Standards).

Coding of diagnoses, procedures, and DRGs

- *Diagnoses and procedures must be coded using the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)*

- *Significant modifications to ICD-9-CM codes occurred in the early 1990s. IQI definitions only reflect codes valid after October 1, 1994, and therefore may not accurately analyze data collected before 1994.*

- Diagnoses and procedure codes should be in character strings.

- Diagnosis and procedure codes should not contain any decimal points.

- Diagnosis and procedure codes should be left justified. Diagnosis codes with fewer than five digits should be padded with spaces (not zeros) on the right. Procedure codes with fewer than four digits should be padded with spaces (not zeros) on the right.

- *The IQI programs assume accurate and specific coding of ICD codes. If an ICD code is specified using 5 digits, the software recognizes only 5-digit versions of that code and not truncated versions at 3 or 4 digits. Similarly, if an ICD code is specified using 4 digits, the software recognizes on 4-digit versions of that code and not truncated versions at 3 digits. For example, 4281 is the ICD-9-CM diagnosis code for left heart failure. If your data are coded less specifically (i.e., 428 is used to designate "heart failure"), these less specific codes are not recognized by the software and will result in undercounting cases.*

- This software has ICD-9-CM codes updated through FY2001 changes.

- Diagnosis-related groups (DRGs) are those derived from the Centers for Medicare & Medicaid Services (previously Health Care Financing Administration) Medicare grouper. The software expects that you will be using the DRG effective on the discharge date. The software now refers to data elements DRG and MDC. Your data should be coded accordingly. The software may be modified at the user's option to use other types of DRGs. However, the impact of using other types of DRGs should be evaluated carefully before making such a change.

- *Version 2.1 of the software accounts for ICD-9-CM and DRG coding effective through September 30, 2001*.

Missing values

- *The IQI programs do not distinguish among different types of missing values.*

Data files of hospital discharge abstract data may have numeric data elements coded using special SPSS missing values. For example, besides the standard SPSS value of "." for missing data, there might also be present values of –1 for invalid data, -2 for data unavailable from a particular source, -3 for inconsistent data. However, the IQI programs do **not** distinguish among the different types of missing codes. Therefore, all types of missing values in the input data to the IQI module can be represented by a single value - missing data (.) for numeric variables and blank (' ') for alphanumeric (or character) variables.

APR-DRG variables

It is recommended that users run version 15 of 3M's APR-DRG software on their patient data before running the IQI programs in order to create APR DRG categories, and severity and mortality indicators. These APR-DRG variables are used to enhance the risk-adjustment of the IQI provider indicators. The discussion of the

interpretation of risk-adjusted IQI results on page 39 addresses the advantages to be gained by using the APR-DRG information in the risk-adjustment process.

- *APR-DRG software is **not** provided as part of the IQI module. It must be obtained separately.*

- *Users who wish to use APR-DRG results to risk-adjust the provider IQI rates should run their APR-DRG software on their patient data **before** running the IQI programs.*

- *Users not using the APR-DRG variables in the risk adjustment should leave these variables off the input dataset and set the !apr parameter to 'none' on program 3 **(!let !apr='none'.)***

User options

The IQI software reflects the development and implementation of the software in data available to AHRQ. Our goal was to develop the tools, illustrate their use, and then encourage others to adopt and use the tools for their own applications. As a result, we expect and encourage users of the software to consider whether and how to modify the IQI software to better serve their local conditions or interests.

Modifications to the definitions of outcomes of interest (numerators) or populations at risk (denominators) are possible but not desirable. Maintaining consistent definitions is important. Once definitions are altered, the ability to make comparisons of IQIs based on original definitions is lost. We encourage users to identify ways to improve the IQI methodology and to share their suggestions with us for future updates.

AHRQ will provide national estimates using the IQIs through its web-based query system, HCUPnet (http://hcup.ahrq.gov/HCUPnet.asp). If users change definitions of the IQIs, it will not be possible to compare users' results to the national estimates in HCUPnet.

Processing steps

Each Inpatient Quality Indicator (IQI) expressed as a rate, is simply defined as:

Outcome of interest / Population at risk

[or]

Numerator / Denominator

Conceptually, five steps are necessary to produce the IQI rates. The following describes the steps and how the software performs them.

1. Identify outcomes in inpatient records

Inpatient records are marked to indicate whether they contain the outcome of interest (numerator or "top") for each of the AHRQ IQI measures.

This is done by setting a series of flag variables, each of which corresponds to the numerator for a particular IQI. For example, if the inpatient record meets the conditions for inclusion in the outcome for IQI #1, then the outcome indicator for IQI #1 is set to one.

This step requires one pass through the discharge-level data and outputs a discharge-level data file containing the flag indicator variables for the outcomes for each IQI. This output file also contains the original input variables, with the exception of the diagnosis and procedure variables which have been removed to reduce the size of the output file.

The first seven Inpatient Quality Indicators are volume measures, and for these QIs this first step is all that is necessary. The remaining steps two though five are relevant for the remaining indicators which are rates as opposed to total volume measures.

2. Identify populations at risk

For the Provider IQIs, the populations at risk (the denominators for calculating the IQI rates, or "pop") are derived from the hospital discharge records.

For the four Area IQIs, the populations at risk (the denominators for calculating the IQI rates) are derived from Census population figures.

3. Calculate observed (raw) Inpatient Quality Indicator rates

Using the output data from step 1 and either hospital discharge or Census population data from step 2, the IQI rates are calculated for user-specified combinations of stratifiers. These stratifiers include hospitals, age groups, race/ethnicity categories, sex, and payer categories for the Provider IQIs, and areas (MSAs/counties), age groups, race/ethnicity categories, and sex for the Area IQIs.

The programs calculate observed IQI rates regardless of the number of cases available. However, IQI rates based on only a few cases should be interpreted with caution.

In work at AHRQ, we do not report rates based on fewer than 30 cases in the numerator or the denominator. This exclusion rule serves two purposes:

- It eliminates unstable estimates based on too few cases.
- It helps protect the identities of hospitals and patients.

This step outputs the observed rates for user-specified categories, alone or in combination. For example, Provider IQI observed rates could be output at the hospital level, at the payer level, or at the hospital level by payer.

4. Risk adjust the Inpatient Quality Indicator rates.

Overall file means and regression coefficients from a baseline database (reflecting a large proportion of the U.S. population) are applied to the observed rates to risk-adjust the rates observed in the user's data. These baseline file means and regression coefficients are provided as part of the IQI module. The risk-adjusted rates will then reflect the age and sex distribution (and the APR DRG distribution for the provider indicators) of data in the baseline file rather than the distribution for the hospitals or areas present in the users' data. This will allow risk-adjusted rates produced by various users to be compared directly to one another. The overall means and regression coefficients were derived from AHRQ's State Inpatient Data (SID) for 28 states. The code to generate these baseline means and coefficients are not part of the IQI module.

For the provider indicators, if there are fewer than three discharges for the particular IQI for a particular combination of stratifiers, then the risk-adjusted rate for that combination of stratifiers is set to missing.

5. Create MSX smoothed rates.

Shrinkage factors are applied to the risk-adjusted rates for each IQI in a process called multivariate signal extraction (MSX). These shrinkage factors were calculated from the SID database of 28 states. For each IQI, the shrinkage estimate reflects a 'reliability adjustment' unique to each indicator. The less reliable the IQI over time and across hospitals or areas, the more the estimate 'shrinks' the IQI toward the overall area mean. The resulting rate will appear "smoother" than the raw rate, meaning the year-to-year fluctuations in performance are likely to be reduced. More information on interpreting smoothed rates is contained in the interpretation section of this document. The shrinkage factors are provided as part of the IQI software and do not need to be calculated by users.

These five steps reflect the IQI module production in a nutshell. The next section of this document describes the specifics of each software component of the IQI module software.

Program descriptions

This section describes the five SPSS programs that assign, calculate, and print the Inpatient Quality Indicators.

For each program there is a description, a list of input and output files, and an explanation of changes to the program that may be required. The flow of data through the IQI module programs is shown in the flowcharts in Figures 1 and 2 that begin on page 7.

If you desire to create and examine observed IQI rates, then the IQSPS1 program will need to be used, followed by IQSPSP2 (for Provider observed rates and volume indicators) and/or IQSPSA2 (for Area observed rates). If you also wish to create risk-adjusted and smoothed IQI rates, then you will also need to run the IQSPSP3 and/or the IQSPSA3 program.

Program 1: run IQSPS1.SPS

The IQSPS1 program processes hospital discharge abstract data and flags inpatient records if they contain outcomes of interest. Outcome indicator names, or numerators, have prefix of "T" (Top). Stratifier variables are constructed at the beginning of the program.

This program assumes that the input data file (consisting of inpatient discharge abstract data) conforms to specific variable names, attributes, and coding conventions. See Table 4 on page 13 for variable names and attributes for the input data file.

Partial definitions of the Inpatient Quality Indicators are given in Table 1 on page 9. This table is presented to assist those individuals who desire to examine the software source code statements. Complete definitions of the indicators are given in Appendix A of the "*Guide to Inpatient Quality Indicators".*

Input:

1. User supplied SPSS inpatient data set consisting of administrative hospital discharge abstract data. This data set is a discharge level file with an array of diagnosis and procedure codes, among other data elements.

Output:

1. SPSS dataset containing inpatient records with input variables, stratifiers, and flag indicators (TPIQxx and TAIQxx) for the outcomes of interest that will later form the numerators for the IQI rates.

2. DESCRIPTIVE statististics (with N, MIN, MAX, MEAN, and SUM) of all of the numeric variables in the output data file.

Changes:

1. The !TEMPDIR parameter specifies the name of a directory the program will use to store temporary datasets while the program is executing. Once the program completes the datasets in this directory can be safely deleted

2. The !PERMDIR parameter specifies the name of a directory the program will use to keep permanent datasets. The input dataset must be saved in this location.

3. The !TEXTDIR parameter specifies the name of the directory where all AHRQ-supplied text files have been saved. These text files should not be converted to SPSS datasets

4. The !INDATA parameter specifies the name of the input dataset of hospital discharge records to be processed. It must be located in the directory specified by the !PERMDIR parameter.

5. The !OUTDATA parameter specifies the name of the output SPSS dataset which contain the IQI flags.

6. The !MAXDX specifies the number of diagnosis variables on the hospital discharge records to be processed.

7. The !MAXPR specifies the number of procedure variables on the hospital discharge records to be processed.

Program 2: run IQSPSP2.SPS

For all but the volume indicators (IQIs 01-07), the IQSPSP2 program calculates the observed or raw rates for the provider-level Inpatient Quality Indicators, using the data derived in a previous step (IQSPS1). These observed rates are stratified by combinations of providers, sex, age, race, and payer categories. The program first totals the indicator flags created by the IQSPS1 program and then for each of the desired stratifiers divides these totals by the hospital discharges in the universe for the indicator. The population denominators are stored in variables with names that have a prefix of "P" (Pop). The Observed rates are stored in variables that have a prefix of "O".

Input:

1. The SPSS dataset that was created in the IQSPS1. This is a discharge-level file that contains inpatient records with input variables, stratifiers, and the 27 new flag indicators for the IQI Provider outcomes of interest.

Output:

1. SPSS dataset with summary records that contain observed rates (OPIQxx variables where xx refers to the indicator number), the counts of outcomes that formed the numerators of the rates (TPIQxx variables), and the hospital discharge totals that formed the denominators of the observed rates (PPIQxx variables). The output file has records summarized to the various combinations of stratifiers specified in the !STRLEVS parameter that is described in item 6 in the "Changes" section below. Note that the observed rates and the denominator totals are not generated for the Provider volume indicators (IQIs 01-07).

2. DESCRIPTIVE statistics (with N, MIN, MAX, MEAN, and SUM) of the provider-level summary records that shows statistics for the OPIQxx observed rates, the TPIQxx counts of outcomes that formed the numerators of the rates, and the PPIQxx counts of outcomes that formed the denominators of the rates. These means will only be generated if the user included a value of 16 for the !STRLEVS parameter discussed in item 6 in the "Changes" section below.

3. Optional LISTING of the output summary dataset is provided at the end of the hardcopy printout. This printout may be quite large depending on the number and the types of stratifications that the user requests with the !STRLEVS parameter discussed in item 6 in the "Changes" section below. If the user does not wish to generate this printout, then the paramter !PRINT should be set to 'no'.

Changes:

1. The !TEMPDIR parameter specifies the name of a directory the program will use to store temporary datasets while the program is executing. Once the program completes the datasets in this directory can be safely deleted

2. The !PERMDIR parameter specifies the name of a directory the program will use to keep permanent datasets. The input dataset must be saved in this location.

3. The !INDATA parameter specifies the name of the input dataset of hospital discharge records output from program IQSPS1. It must be located in the directory specified by the !PERMDIR parameter.

4. The !OUTDATA parameter specifies the name of the output SPSS dataset which contain the observed rates.

5. The !PRINT parameter specifies whether the records in the final dataset should be printed. Possible values are yes or no.

6. The !STRLEVS parameter specifies all the cross classifications among age category, sex, race category and provider for which rates should be calculated. The values should be specified as a list enclosed by quotes, eg '16 17', to specify provider and provider by sex, respectively. Table 5 shows the possible values for!STRLEVS.

Table 5. IQSPSP2 aggregation choices

	Stratification								
1									Race
2							Payer		
3							Payer	*	Race
4					Sex				
5					Sex	*			Race
6					Sex	*	Payer		
7					Sex	*	Payer	*	Race
8			Age						
9			Age	*					Race
10			Age	*			Payer		
11			Age	*			Payer	*	Race
12			Age	*	Sex				
13			Age	*	Sex	*			Race
14			Age	*	Sex	*	Payer		
15			Age	*	Sex	*	Payer	*	Race
16	**Provider**								
17	Provider	*							Race
18	Provider	*					Payer		
19	Provider	*					Payer	*	Race
20	Provider	*			Sex				
21	Provider	*			Sex	*			Race
22	Provider	*			Sex	*	Payer		
23	Provider	*			Sex	*	Payer	*	Race
24	Provider	*	Age						
25	Provider	*	Age	*					Race
26	Provider	*	Age	*			Payer		
27	Provider	*	Age	*			Payer	*	Race
28	Provider	*	Age	*	Sex				
29	Provider	*	Age	*	Sex	*			Race
30	Provider	*	Age	*	Sex	*	Payer		
31	Provider	*	Age	*	Sex	*	Payer	*	Race

Level 0 (overall) is generated automatically.

For example, if you are using a state inpatient hospital database, you might specify the following !STRLEVS values:

8 – provides overall rates for your state, broken down by age groups
16 – provides rates for providers within your state
24 – provides rates for age groups within these providers

Program 3: run IQSPSP3.SPS

The IQSPSP3 program calculates age and sex (and APR-DRG, if available) risk-adjusted rates for each IQI and then calculates smoothed rates. The risk-adjusted and smoothed rates are not calculated for the Provider volume indicators, IQIs 01-07, just as observed rates were not calculated for these indicators.

When there are fewer than three discharges within a stratification cell, the risk-adjusted rates are set to missing. The smoothed rates that are based on these risk-adjusted rates are also set to missing.

The output file should have records summarized to the various combinations of stratifiers that were specified in the !STRLEVS parameter of the preceding QISPSP2 program. See table 5 on page 23.

Input:

1. The discharge-level file that was created by the IQSPS1 program.

2. The SPSS dataset with summary records that was created with the IQSPSP2 program.

3. A text file (MEANSP00.TXT) containing overall means from the reference SID dataset for use in the risk adjustment process. This file is provided to you as part of the IQI module. The text file does not need to be converted to a SPSS file for use with the software.

4. A text file (COVARP00.TXT) containing regression coefficients from a regression that was run on a reference SID dataset. These coefficients will be used in the risk adjustment process. This file is provided to you as part of the IQI module. The text file does not need to be converted to a SPSS file for use with the software.

5. A text file (MSXP_00.TXT) containing three arrays for use in the smoothing process. The arrays contain noise estimates, signal estimates, and mean area rates for each IQI. This file is provided to you as part of the IQI module. The text file does not need to be converted to a SPSS file for use with the software.

Output:

1. A SPSS dataset with an overall summary record and with provider-level summary records that contain the three types of indicator rates, along with the components of the initial raw rates. Specifically, the file contains the observed rates (OPIQxx variables), the risk-adjusted rates (RPIQxx variables), the smoothed rates (SPIQxx variables), the counts of outcomes that formed the numerators of the observed rates (TPIQxx variables), and the hospital discharge totals that formed the denominators of the observed rates (PPIQxx variables).

2. DESCRIPTIVE statistics (with N, MIN, MAX, MEAN, and SUM) of the provider-level summary records that shows statistics for the observed, risk-adjusted and smoothed rates, and statistics for the counts of outcomes that formed the numerators and denominators of the observed rates. These means will only be generated if the user included a value of 16 for the !STRLEVS parameter of the QISPSP2 program. See table 5 on page 23.

3. Optional LISTING of the output summary dataset is provided at the end of the hardcopy printout. This printout may be quite large depending on the number and the types of stratifications that the user requested with the !STRLEVS parameter of the preceding QISPSP2 program. See table 5 on page 23. If the user does not wish to generate this printout, then the !PRINT parameter should be set to no.

Changes:

1. The !TEMPDIR parameter specifies the name of a directory the program will use to store temporary datasets while the program is executing. Once the program completes the datasets in this directory can be safely deleted

2. The !PERMDIR parameter specifies the name of a directory the program will use to keep permanent datasets.

3. The !TEXTDIR parameter specifies the name of the directory where all AHRQ-supplied text files have been saved. These text files should not be converted to SPSS datasets

4. The !INDATA1 parameter specifies the name of the input dataset of hospital discharge records from program IQSPS1. It must be located in the directory specified by the !PERMDIR parameter.

5. The !INDATA2 parameter specifies the name of the dataset produced by IQSPSP2. It must be located in the directory specified by the !PERMDIR parameter.

6. The !OUTDATA parameter specifies the name of the output SPSS dataset with the risk adjusted and smoothed rates. It will be saved to the directory specified by the !PERMDIR parameter.

7. The !STRLEVS parameter specifies all the cross classifications among age category, sex, race category and provider for which rates should be calculated. The values should agree with those specified on the IQSPSP2 program.

8. The !PRINT parameter specifies whether the final dataset's records should be printed or not. The possible values are yes or no.

9. The !COVARP parameter specifies the name of the text file (located within the directory specified by !TEXTDIR) that contains the regression coefficients (covarp00.txt) to risk adjust the observed rates.

10. The !MEANSP parameter specifies the name of the text file (located within the directory specified by !TEXTDIR) that contains the population means (meansp00.txt) to risk adjust the observed rates.

11. The !MSX parameter specifies the name of the text file (located within the directory specified by !TEXTDIR) that contains the signal and noise coeficients (msxp_00.txt) to smooth the risk adjusted rates.

12. The !APR parameter specifies the name of the APR-DRG variable in the input dataset which was output from the 3M APR-DRG software to risk adjust the observed rates. This variable is not required for the risk adjustment; however, if it is not present, this parameter should be set to the word none. It should not be left blank.

13. The !SEVER parameter specifies the name of the severety score variable in the input dataset which was output from the 3M APR-DRG software to risk adjust the observed rates. This variable is not required for the risk adjustment. If it is not present, the parameter can be left blank.

14. The !MORT parameter specifies the name of the mortality risk variable in the input dataset which was output from the 3M APR-DRG software to risk adjust the observed rates. This variable is not required for the risk adjustment. If it is not present, the parameter can be left blank.

Program 4: run IQSPSA2.SPS

The IQSPSA2 program calculates the observed or raw rates for the area-level Inpatient Quality Indicators, using the data derived in a previous step (IQSPS1). These observed rates are stratified by combinations of area, sex, age, and race categories. The program first totals the four area indicator flags created by the IQSPS1 program, and then for each of the desired stratifiers divides these totals by the pertinent residential population. The population denominators are stored in variables with names that have a prefix of "P" (Pop). The Observed rates are stored in variables that have a prefix of "O".

Input:

1. The SPSS dataset that was created by the IQSPS1 program. This is a discharge-level file that contains inpatient records with input variables, stratifiers, and the four new flag indicators for the IQI Area outcomes of interest.

2. An AHRQ-supplied text file with Census area residential populations, stratified by area, age, sex, and ethnicity categories. Five such files are currently provided along with the IQI module software. The files are QIPOP97, QIPOP98, QIPOP99, QIPOP00 and QIPOP01. The user should select the file for the year that best matches the user's discharge datafile.

   *Users do **not** need to convert the ASCII text file to a SPSS dataset for use with the software.*

Output:

1. SPSS dataset with summary records that contain observed rates (OAIQxx variables where xx refers to the indicator number), the counts of outcomes that formed the numerators of the rates (TAIQxx variables), and the residential population totals that formed the denominators of the observed rates (PAIQxx variables). The output file has records summarized to the various combinations of stratifiers specified in the !STRLEVS parameter that is described in item 7 in the "Changes" section below.

2. DESCRIPTIVE statistics (with N, MIN, MAX, MEAN, and SUM) of the area-level summary records that shows statistics for the OAIQxx observed rates, the TAIQxx counts of outcomes that formed the numerators of the rates, and the PAIQxx residential populations totals. These means will only be generated if the user included a value of 8 for the !STRLEVS parameter discussed in item 7 in the "Changes" section below.

3. Optional LISTING of the output summary dataset is provided at the end of the hardcopy printout. This printout may be quite large depending on the number and the types of stratifications that the user requests with the !STRLEVS parameter discussed in item 7 in the "Changes" section below. If the user does not wish to generate this printout, then the !PRINT parameter to NO or no.

Changes:

1. The !TEMPDIR parameter specifies the name of a directory the program will use to store temporary datasets while the program is executing. Once the program completes the datasets in this directory can be safely deleted

2. The !PERMDIR parameter specifies the name of a directory the program will use to keep permanent datasets. The input dataset must be saved in this location.

3. The !TEXTDIR parameter specifies the name of the directory where all AHRQ-supplied text files have been saved. These text files should not be converted to SPSS datasets

4. The !INDATA parameter specifies the name of the input dataset of hospital discharge records output from the IQSPS1 program. It must be located in the directory specified by the !PERMDIR parameter.

5. The !OUTDATA parameter specifies the name of the output SPSS dataset which contain the observed rates. It will be saved in the directory specified by the !PERMDIR parameter.

6. The !PRINT parameter specifies whether the records in the final dataset should be printed. Possible values are yes and no.

7. The !STRLEVS parameter specifies all the cross classifications among age category, sex, race category and area for which rates should be calculated. The values should be specified as a list enclosed by quotes, eg '8 10', to specify area and area by sex, respectively. Table 6 shows the possible values for !STRLEVS.

WARNING: *STRLEVS must include the value 8 (area) if you wish to subsequently run program IQSPSA3 for risk-adjusted and smoothed rates.*

Table 6. IQSPSA2 aggregation choices

	Stratification								
1									Race
2						Sex			
3						Sex	*		Race
4			Age						
5			Age	*					Race
6			Age	*		Sex			
7			Age	*		Sex	*		Race
8	**Area**								
9	Area	*							Race
10	Area	*				Sex			
11	Area	*				Sex	*		Race
12	Area	*	Age						
13	Area	*	Age	*					Race
14	Area	*	Age	*		Sex			
15	Area	*	Age	*		Sex	*		Race

Level 0 (overall) is generated automatically.

For example, if you are using a state inpatient hospital database, you might specify the following !STRLEVS values:

4 – provides overall rates for your state, broken down by age groups
8 – provides rates for areas within your state
12 – provides rates for age groups within these areas

Program 5: run IQSPSA3.SPS

The IQSPSA3 program calculates age and sex risk-adjusted rates for each area-based IQI (overall rates and rates by area), and then calculates smoothed rates.

Input:

1. The discharge-level file that was created with the IQSPS1 program.

2. The SPSS dataset with summary records that was created with the IQSPSA2 program.

3. A text file with Census area residential populations, stratified by area, sex, and discrete age categories. Five such files are currently provided along with the IQI module software. The files are QIPOP**A**97, QIPOP**A**98, QIPOP**A**99, QIPOP**A**00 and QIPOP**A**01. The user should select the file for the year that best matches the user's discharge datafile. The text file does not need to be converted to a SPS file for use with the software.

4. A text file (MEANSA00.TXT) containing overall means from the reference SID dataset for use in the risk adjustment process. This file is provided to you as part of the IQI module. The text file does not need to be converted to a SPS file for use with the software.

5. A text file (COVARA00.TXT) containing regression coefficients from a regression that was run on the reference SID dataset. These coefficients will be used in the risk adjustment process. This file is provided to you as part of the IQI module. The text file does not need to be converted to a SPS file for use with the software.

6. A text file (MSXA_00.TXT) containing three arrays for use in the smoothing process. The arrays contain noise estimates, signal estimates, and mean area rates for each IQI. This file is provided to you as part of the IQI module. The text file does not need to be converted to a SPSS file for use with the software.

Output:

1. A SPSS dataset with an overall summary record and with area-level summary records that contain the three types of indicator rates, along with the components of the initial raw rates. Specifically, the file contains the observed rates (OAIQxx variables), the risk-adjusted rates (RAIQxx variables), the smoothed rates (SAIQxx variables), the counts of outcomes that formed the numerators of the observed rates (TAIQxx variables), and the residential population totals that formed the denominators of the observed rates (PAIQxx variables).

4. DESCRIPTIVE statistics (with N, MIN, MAX, MEAN, and SUM) of the area-level summary records that shows statistics for the OAIQxx observed rates and their TAIQxx and PAIQxx components, the RAIQxx risk-adjusted rates, and the SAIQxx smoothed rates.

5. Optional LISTING of the output summary dataset is provided at the end of the hardcopy printout. If the user does not wish to generate this printout, then the global !PRINT parameter should be set to no.

Changes:

1. The !TEMPDIR parameter specifies the name of a directory the program will use to store temporary datasets while the program is executing. Once the program completes the datasets in this directory can be safely deleted

2. The !PERMDIR parameter specifies the name of a directory the program will use to keep permanent datasets. The input dataset must be saved in this location.

3. The !TEXTDIR parameter specifies the name of the directory where all AHRQ-supplied text files have been saved. These text files should not be converted to SPSS datasets

4. The !INDATA1 parameter specifies the name of the input dataset of hospital discharge records from program IQSPS1. It must be located in the directory specified by the !PERMDIR parameter.

5. The !INDATA2 parameter specifies the name of the dataset produced by IQSPSA2. It must be located in the directory specified by the !PERMDIR parameter.

6. The !OUTDATA parameter specifies the name of the output SPSS dataset with the risk adjusted and smoothed rates. It will be saved in the directory specified by the !PERMDIR parameter.

7. The !PRINT parameter specifies whether the final dataset's records should be printed or not. The possible values are yes and no.

8. The !COVARA parameter specifies the name of the text file (located within the directory specified by !TEXTDIR) that contains the regression coefficients (covara00.txt) to risk adjust the observed rates.

9. The !MEANSA parameter specifies the name of the text file (located within the directory specified by !TEXTDIR) that contains the population means (meansa00.txt) to risk adjust the observed rates.

10. The !MSX parameter specifies the name of the text file (located within the directory specified by !TEXTDIR) that contains the signal and noise coeficients (msxa_00.txt) to smooth the risk adjusted rates.

Reviewing the printed output.

This section contains tips for reviewing some of the printed output from the IQI module. These tips are oriented toward explaining the interrelationships between printout items from different programs and hopefully will help to reveal the nature and structure of the module outputs. For guidance in interpreting the results, see the next section which begins on page 35.

The final output of the IQI module is a LISTING from IQSPSP3 (for provider-level indicators) and IQSPSA3 (for area-level indicators). All interim printouts are for checking and trouble-shooting. However, if you have elected to refrain from risk-adjusting and smoothing the data, then the final outputs will be the LISTING at the end of the IQSPSP2 and/or IQSPSA2 programs.

IQSPS1

The initial printout from the IQSPS1 program contains DESCRIPTIVES for all of the numeric variables in the output discharge-level dataset. It will contain information for the newly constructed TAIQxx and TPIQxx flag variables that will later form the numerators for the indicator rates. For each TAIQxx and TPIQxx flag variable:

- The SUM will contain the total number of observations in the dataset that were found to have the particular outcome of interest.

- For the seven Provider volume indicators (TPIQ01-TPIQ07) and the four Area indicators (TAIQ26-TAIQ29), the MEAN, MINIMUM, and MAXIMUM will usually be the value one since the flag variables have either been set to missing ('.') or to a value of one. The remainder of the Provider indicators (TPIQ08-TPIQ25, and TPIQ30 & TPIQ31) have a value of one, zero, or missing ('.'). For these indicators, a value of zero was assigned to the TPIQxx flag if a particular observation was part of the population at risk for a particular indicator but did not have the particular outcome of interest. So for example, TPIQ21 = 1 indicates a patient who had a Cesarean section, while TPIQ21 = 0 identifies a patient who had a delivery but not a C-section.

- For the Provider indicators TPIQ08-TPIQ25 and TPIQ30 & TPIQ31, the MEANs will contain a close approximation of the eventual overall observed indicator rates. The values will change slightly after IQSPSP2 has applied additional parts of the indicator definitions.

- N lists the number of observations in the dataset with non-missing values. For the seven provider-based volume indicators and the four area-based indicators, N for TPIQxx or TAIQxx will be the same as the SUM. For the other provider-based indicators, N will contain the denominator for the observed indicator rate. Note: the N's or denominators for seven of the mortality indicators (# 8-12, 30 & 31) will be similar to the Ns and SUMs for the seven volume indicators (TPIQ01-TPIQ07), but often they will not be exactly identical since the mortality indicators exclude discharges that were transferred to other hospitals.

IQSPSP2

The purpose of this printout is to provide the observed rates for all provider-level indicators. The default printout shows results by provider, but other levels of output (as shown in Table 5) can be specified as well. Note that risk-adjusted and smoothed rates are shown in the output from the next program.

The printout from the IQSPSP2 program contains DESCRIPTIVES on the provider-level summary records for all of the numeric variables in the output summary dataset. It will contain information for the newly constructed OPIQxx rates, the PPIQxx denominators, and the TPIQxx numerators.

- The STRAT variable described in the MEANS table identifies the stratification level for the records in the output data set. The STRAT variable corresponds to the !STRLEVS parameter values that were specified (see item 7 in the "Changes" section for the IQSPSP2 program on page 27). In this case, STRAT always assumes the value of 16, since only the provider-level records are selected.

- The N statistic for STRAT contains the number of providers in the output summary data set. A TPIQxx numerator variable with a value for N that is lower than the N value for STRAT indicates that there were no outcomes of interest for some of the providers. Similarly, a PPIQxx denominator variable with a lower value for N than STRAT indicates that for some providers, there were no hospital discharges with the outcome of interest.

- The MINIMUM value for the TPIQ08-TPIQ25, TPIQ30 and TPIQ31 numerators will usually be zero since values of zero were assigned for observations that were part of the population for the rate denominator but did not have the particular outcome of interest to be included in the rate numerator. For the volume indicators, (TPIQ01-TPIQ07), the MINIMUM value will be one or higher.

*For the observed rates, the User should **NOT** report the MEANS displayed here, but instead should refer to the overall means in the output dataset that are also present in the subsequent LISTING. The MEANS given here are means of hospital means; i.e., all hospitals are given equal weight, regardless of the number of discharges in the different hospitals.*

- The SUMs for the counter variables TPIQxx and PPIQxx will contain overall file totals for these data elements. The SUMs for the observed rates have no intuitive meaning.

If the !PRINT parameter is set to yes, the subsequent LISTING output contains a complete dump of the output summary file. Listed for each record are the stratification values, the PPIQxx population denominators for the 27 provider indicators, the TPIQxx outcome numerators for the 27 provider indicators, and the 27 OPIQxx observed rates.

IQSPSP3

*The LISTING at the end of this program provides your **final output**. (This prinout appears if the !PRINT parameter is set to yes.) It lists the numerator and the denominator, along with the observed, risk-adjusted, and smoothed rates for all indicators, as shown in the following example.*

SAMPLE DATA

Cesarean Section Delivery

List

HOSPID	AGECAT	SEXCAT	PAYCAT	RACECAT	TPIQ21	PPIQ21	OPIQ21	RPIQ21	SPIQ21
.					15487.00	75896.00	.2041	.2045	.2046
4004					60.0000	628.0000	.0955	.1108	.1222
4006					6.0000	14.0000	.4286	.4228	.2665
4015					9.0000	23.0000	.3913	.4030	.2773
4022					1481.000	6789.000	.2181	.2230	.2231
4031					118.0000	563.0000	.2096	.2201	.2214
4042					221.0000	1395.000	.1584	.1624	.1655
4060					2.0000	53.0000	.0377	.0612	.1556
4076					103.0000	587.0000	.1755	.1861	.1907
4084					92.0000	700.0000	.1314	.1421	.1497
4088					188.0000	1564.000	.1202	.1289	.1330
4093					.	.0000	.	.	.
4096					247.0000	1937.000	.1275	.1455	.1483
4097					358.0000	2961.000	.1209	.1372	.1393
4100					48.0000	283.0000	.1696	.1860	.1948
6002					420.0000	1638.000	.2564	.2510	.2503
6003					92.0000	401.0000	.2294	.2332	.2332
6008					28.0000	143.0000	.1958	.2074	.2153

In this example printout, observation 1 (with HOSPID = .) is the overall average for the entire dataset (STRAT = 0). The remaining observations are individual providers, or hospitals (STRAT = 16). Data will appear under the column headers, AGECAT, SEXCAT, PAYCAT, and RACECAT, if you specify these levels of aggregation (shown in Table 5).

You may wish to express the results in more understandable terms:

- Multiply the utilization rates by 100 to express them as a percentage (e.g., 0.2040 * 10 = 20.4% C-section rate)

The MEANS table is generated from the permanent provider-based output file and is provided for trouble-shooting and understanding your data, but not for reporting. The means are provided just for the provider level summary records.

- The N for all but the TPIQxx counter variables should contain the number of providers in the users database.

- The MEANS, MINIMUMs, and MAXIMUMs have their normal meaning and provide comparisons among the different hospitals or providers in your database.

*For the (observed, risk-adjusted, or smoothed) rates, the User should **NOT** report the MEANS displayed here, but instead refer to the overall means in the output dataset in the LISTING labeled "FINAL OUTPUT." The MEANS given here are means of hospital means; i.e., all hospitals are given equal weight, regardless of the number of discharges in the different hospitals.*

- Note: The denominators for seven of the mortality indicators (# 8 - 12, 30 & 31) will be similar to the totals for the seven volume indicators (TPIQ01-TPIQ07), but often they will not be exactly identical since the mortality indicators exclude discharges that were transferred to other hospitals.

- Note: Smoothed rates are not computed for two indicators: #8 esophageal resection mortality and #31 carotid endarterectomy mortality. These events are so infrequent that our analyses could not detect enough systematic provider level variation to compute the smoothed rates.

- If the !PRINT parameter is set to yes, at the end of the printout is a LISTING on the final provider-based output file. Listed for each level of stratification are the stratifiers, the numerator and denominator totals for the observed rates, and the observed, risk-adjusted, and smoothed rates.

IQSPSA2

The purpose of this printout is to provide the observed rates for all area-level indicators. The default printout shows overall results and results by area, but other levels of output (as shown in Table 6) can be specified as well. Note that risk-adjusted and smoothed rates are shown in the output from the next program.

The printout from the IQSPSA2 program contains DESCRIPTIVES for all of the numeric variables in the output summary dataset. It will contain information for the newly constructed OAIQxx rates, the PAIQxx denominators, and the TAIQxx numerators.

- The STRAT variable described in the first row of the MEANS table identifies the stratification level for the records in the output data set. The STRAT variable corresponds to the !STRLEVS parameter values that were specified (see item 7 in the "Changes" section for the IQSPSA2 program on page 27). In this case, STRAT always assumes the value of 8, since only the area-level records are selected.

- The N statistic for STRAT contains the number of areas in the output summary data set. A TAIQxx numerator variable with a lower value for N than STRAT indicates that there were no outcomes of interest for some of the areas.

- The MINIMUM value for the TAIQxx numerators will be one or higher.

*For the observed rates, the User should **NOT** report the MEANS displayed here, but instead should refer to the overall means in the output dataset that are also present in the subsequent LISTING. The MEANS given here are means of the area means; i.e., all areas are given equal weight, regardless of the population in the different areas.*

- The SUMs for the counter variables TAQIxx and PAIQXX will contain overall file totals for these data elements. The SUMs for the observed rates have no intuitive meaning.

If the !PRINT parameter is set to yes, the subsequent LISTING output contains a complete dump of the output summary file. Listed for each record are the stratification values, the PAIQxx population denominators for the four indicators, the TAIQxx outcome numerators for the four indicators, and the four OAIQxx observed rates.

IQSPSA3

*The LISTING at the end of this program provides your **final output**. (This printout appears if the !PRINT parameter is set to yes.) It lists the numerator and the denominator, along with the observed, risk-adjusted, and smoothed rates for all indicators, as shown in the example output below.*

SAMPLE DATA

Hysterectomy

List

AREA	TAIQ28	PAIQ28	OAIQ28	RAIQ28	SAIQ28
04001	6.0000	21500.0000	.0003	.0004	.0005
04003	18.0000	40162.2000	.0004	.0005	.0006
06093	105.0000	16434.8000	.0064	.0062	.0061
0680	193.0000	204581.0000	.0009	.0010	.0010
2620	224.0000	40796.2000	.0055	.0056	.0056
2840	91.0000	291455.6000	.0003	.0004	.0004
4120	249.0000	464234.2000	.0005	.0005	.0005
4472	2079.0000	5666578.2000	.0004	.0004	.0004
6200	929.0000	1061197.4000	.0009	.0010	.0010
6922	587.0000	625208.4000	.0009	.0009	.0009
7320	483.0000	997698.4000	.0005	.0006	.0006
7362	815.0000	2588752.6000	.0003	.0002	.0002
7460	104.0000	84574.8000	.0012	.0015	.0015
7480	104.0000	143320.2000	.0007	.0011	.0011
8520	17.0000	299604.0000	.0001	.0003	.0003
8780	.	114801.4000	.0000	.0001	.0001

You may wish to express the results in more understandable terms:

- Multiply the utilization rates by 100,000 to express them as a rate per 100,000 population (e.g., 0.0012 * 100,000 = 120 hysterectomies per 100,000 population).

The MEANS table is generated from the permanent area-based output file. The means are provided just for the area-level summary records.

- The N for all but the TAIQxx counter variables should contain the number of different areas (MSAs and counties) in your database.

- The MEANs, MINIMUMs, and MAXIMUMs have their normal meaning and provide comparisons among the different areas in your database. Note that the MAXIMUMs for the counter variables (the TAIQxx and PAIQxx variables) are associated with specific areas, and therefore these MAXIMUMs may not match those in the prior IQSPS2 printouts since that run typically will include a record for the entire database.

*For the (observed, risk-adjusted, or smoothed) rates, the User should **NOT** report the MEANS displayed here, but instead refer to the overall means in the output dataset that are also present in the subsequent LISTING. The MEANS given here are means of area means; i.e., all areas are given equal weight, regardless of the number of discharges in the different areas.*

- The SUMs of the counter variables (the TAIQxx and PAIQxx variables) yield the overall database totals.

Interpreting the results

The Inpatient Quality Indicators are not intended to be definitive quality measures. Many factors can and do influence performance on quality indicators and some of these factors are independent of quality of care. From our empirical analyses we estimated that generally less than 20% of total patient level variation for each QI is attributable to actual provider-level differences. Though this number appears low, we also estimated that most of this remaining provider-level variation reflects true signal; that is, the observed performance is not likely the result of random variation. We also noted that these true differences in provider performance are potentially clinically important, in that they involve large numbers of patients, severe outcomes, and/or significant cost to the health care system.

Although these indicators are not intended and should not be used as definitive measures of quality, they are useful low-cost screens that can potentially illuminate differences between providers and areas that may be addressable using quality improvement techniques.

Since both very low rates and very high rates for some indicators, such as procedure utilization indicators, may indicate quality problems, and since there are no "right rates" established for most indicators, it is often best to compare provider or area-level rates with other similar providers or areas. These "peer groups" would ideally be as similar as possible in potentially important factors, such as case-mix, socioeconomic status and other demographics. Similar hospitals should perform similarly on QIs. Potential characteristics that have been used to define peer groups have been teaching status, bed capacity, socioeconomic status of the population, and urban or rural location.

Using Indicators in Combination

Performance on a single IQI often cannot reliably indicate actual quality differences. For this reason, some indicators have been developed as measure sets. For instance, stroke care could be measured by the carotid endarterectomy and stroke mortality measures. Examining these indicators together is likely to produce a more complete picture of overall quality of care for this condition.

Indicators are also organized by type – utilization, mortality, volume. Providers that perform better (or worse) than average on one measure within each type tend to perform better (or worse) on others. In other words, performance on indicators is often related, and performance on multiple similar indicators could also be examined as summary indicators for an overall picture of quality.

Similarly, indicators may be related across indicator types. Lower utilization rates may be related to higher, but avoidable, admission rates for some conditions. *Groups of indicators have not been validated as sets, but using them as such may be useful for exploration purposes.*

After performing all of the steps as previously outlined, users will have three estimates of performance for each mortality and utilization IQI – observed, risk-adjusted, and smoothed estimates. For the volume indicators, observed volumes are reported but these are not risk-adjusted or smoothed. This section will outline how the different types of estimates can be interpreted and used.

Volume indicators.

The IQSPSP2 program generates output with the observed counts of procedures performed at a given hospital during the year in question. None of the other programs report on the volume indicators, since risk adjustment is not an issue for volume indicators. Each of these indicators has substantial published evidence suggesting that providers that perform more than a certain number of procedures have better patient outcomes. These thresholds are listed below in Table 7. Threshold 1 is the lowest reported threshold in the literature, while threshold 2 is the highest. Providers exceeding these thresholds are considered high volume providers.

Volume indicators are considered indirect or 'proxy' measures of quality, in that the volume of procedures is often related to outcome measures such as post-operative mortality and complications. However, volume may be increased by performing a larger number of inappropriate procedures. Thus, it is often useful to examine volume measures in conjunction with mortality and complication rates as well as area-level rates of the procedure to account for regional variations in standard practice. For each volume measure in the IQIs, there is a corresponding mortality measure. For two procedures (PTCA and carotid endarterectomy) the mortality measure is intended to be used only with its corresponding volume measure.

Table 7. Thresholds for Volume Indicators				
	Threshold 1	Threshold 2	Reference for Threshold 1	Reference for Threshold 2
Esophageal resection	6	7	Patti MG, Corvera CU, Glasgow RE, et al. A hospital's annual rate of esophagectomy influences the operative mortality rate. J Gastrointest Surg 1998;2(2):186-92.	Dudley RA, Johansen KL, Rand R, et al. Selective referral to high-volume hospitals: estimating potentially avoidable deaths. JAMA 2000;283(9):1159-66.
Pancreatic resection	10	11	Glasgow RD, Mulvihill SJ. Hospital volume influences outcome in patients undergoing pancreatic resection for cancer. West J Med 1996;165(5):294-300	Glasgow, Mulvihill, 1996.
Pediatric heart surgery	100	-	[1]Hannan EL, Racz M, Kavey RE, et al. Pediatric cardiac surgery: the effect of hospital and surgeon volume on in-hospital mortality. Pediatrics 1998;101(6):963-9.	-
AAA repair	10	32	Hannan EL, Kilburn H, Jr., O=Donnell JF, et al. A longitudinal analysis of the relationship between in-hospital mortality in New York state and the volume of abdominal aortic aneurysm surgeries performed. Health Serv Res 1992;27(4):517-42.	Kazmers A, Jacobs L, Perkins A, et al. Abdominal aortic aneurysm repair in Veterans Affairs medical centers. J Vasc Surg 1996;23(2):191-200.
CABG	100	200	Eagle KA, Guyton RA, Davidoff R, et al. ACC/AHA Guidelines for Coronary Artery Bypass Graft Surgery: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1991 Guidelines for Coronary Artery Bypass Graft Surgery). American College of Cardiology/American Heart Association. J Am Coll Cardiol 1999;34(4):1262-347	Hannan EL, Kilburn H, Jr., Bernard H, et al. Coronary artery bypass surgery: the relationship between inhospital mortality rate and surgical volume after controlling for clinical risk factors. Med Care 1991;29(11):1094-107
PTCA	200	400	Ryan TJ, Bauman WB, Kennedy JW, et al. Guidelines for percutaneous transluminal coronary angioplasty. A report of the American Heart Association/American College of Cardiology Task Force on Assessment of Diagnostic and Therapeutic Cardiovascular Procedures (Committee on Percutaneous Transluminal Coronary Angioplasty). Circulation 1993;88(6):2987-3007	Hannan EL, Racz M, Ryan TJ, et al. Coronary angioplasty volume-outcome relationships for hospitals and cardiologists. JAMA 1997;277(11):892-8.
Carotid endarter-ectomy	50	101	Manheim LM, Sohn MW, Feinglass J, et al. Hospital vascular surgery volume and procedure mortality rates in California, 1982-1994. J Vasc Surg 1998;28(1):45-46.	Hannan EL, Popp AJ, Tranmer B, et al. Relationship between provider volume and mortality for carotid endarterectomies in New York state. Stroke 1998;29(11):2292-7. Dudley RA, Johansen KL, Brand R, et al. Selective referral to high-volume hospitals: estimating potentially avoidable deaths. JAMA 2000;283(9):1159-66.

Utilization indicators.

Programs IQSPSA2 andIQSPSP2 give the observed rates for each of the utilization indicators. Programs IQSPSA3 and IQSPSP3 give the risk-adjusted and the MSX smoothed rates.

Most of the utilization indicators are potentially overused procedures. The exceptions are VBAC and laparoscopic cholecystectomy, which are potentially underused. The rates of procedure use are intended to

reflect inappropriate use of the procedure. However, it has been noted in the literature that areas with higher rates of procedures do not necessarily have higher rates of *inappropriate* procedures. Nevertheless, since these areas have higher rates of procedures they may have a higher *number* of inappropriate procedures. Other factors, including patient preference, influence indicator performance.

For most of these procedures there are no “right rates,” meaning there are no gold standards by which to measure performance. Very low rates could signal inappropriate underutilization of procedures. Thus peer group averages may be the best comparison available. Notable exceptions are Bi-lateral cardiac catheterization and incidental appendectomy where the appropriate rate is likely to be very small, and C-section and VBAC rate, which have established Healthy People 2010 goals (15 c-sections per 100 births for first-time cesareans, and 37 VBACs per 100 births in women with previous cesarean section).

Mortality indicators.

Program IQSPSP2 gives the observed rates for each of the mortality indicators, Program IQSPSP3 gives the risk-adjusted and the MSX smoothed rates. Mortality is one of the most important outcomes of healthcare; therefore mortality rates have been examined extensively. Mortality rates, however, tend to have substantial amounts of noise, partly because of their small numbers of observations. For this reason it is recommended that MSX smoothed estimates be used. Case-mix may also substantially affect mortality rates, and use of risk-adjustment, at a minimum with age/sex and APR-DRGs, is recommended.

Both volume and mortality are measured for seven surgical procedures – esophageal resection, pancreatic resection, pediatric heart surgery, abdominal aortic aneurysm (AAA) repair, coronary artery bypass graft (CABG), percutaneous transluminal coronary angioplasty (PTCA), and carotid endarterectomy. The volume indicators simply count the number of admissions in which these procedures were performed. The mortality indicators reflect the number of in-hospital deaths among patients receiving these procedures with the exclusion of those transferring to another institution. Patients transferring to other acute-care hospitals are not eligible to die in the original hospital and therefore should be excluded from the denominator for mortality indicators. If there is a discrepancy between the volume of procedures (from IQISPSP2) and the denominator of the mortality indicator, the difference is simply due to exclusion of transferring patients.

For two mortality indicators (PTCA and carotid endarterectomy), it is recommended that the mortality measures be used only with its corresponding volume measure.

Observed rates.

- *Examine observed rates as baseline measures of performance on the indicators and to see the impact of risk adjustment. (Note: Volume measures are only presented as observed values, or "numerators" in the printouts.)*

With the exception of the volume indicators, the interpretation of the observed (raw) IQI rates may be complicated by concerns over noise and bias. However, the observed rates do not require complex statistical methods as do the risk-adjusted and MSX smoothed rates. For this reason, they are the most intuitive estimates of IQI performance. Observed rates can be used as a baseline measure when comparing to risk-adjusted and MSX smoothed rates, to determine the impact of risk adjustment/smoothing.

Observed rates may fluctuate for some providers from year to year. While some of these fluctuations may indicate true differences in performance, others are due only to random chance (i.e., non-systematic differences among providers or areas in patient characteristics that are not observed, and therefore cannot be adjusted for). For this reason, it is often beneficial to examine observed rates for a given provider over several consecutive time periods. This will help to diminish the chance of inaccurately judging poorer than average or better than average performance during one year as true performance.

Risk-adjusted rates.

For most purposes, you will use the risk-adjusted rates for the mortality and utilization indicators.

Simply put, risk-adjusted rates are the estimated performance of providers or areas on the IQIs if those providers or areas had an 'average' casemix. This average casemix is estimated and included in the software using estimates from 28 States in the SID databases. Estimates of the average casemix do not reflect only the areas or providers in the dataset being analyzed, but rather the distribution in age, sex and APR DRG categories among the providers and areas in the SID data.

Most provider indicators are risk adjusted using age, sex, and APR-DRGs – mortality measures using the risk of mortality score and utilization measures using the severity score (unless the user chooses otherwise, in which case risk adjustment only uses age and sex). A few provider indicators cannot be adjusted using APR-DRGs since the population at risk is characterized by a single APR-DRG without severity classification. These are cesarean section rate, VBAC rate, and laparoscopic cholecystectomy rate, and are risk-adjusted by age and in the case of laparoscopic cholecystectomy, sex. APR-DRGs were selected as the risk adjustment tool because it performed at least as well as other systems in comparative studies, and it fulfilled a variety of other requirements desired by potential users (e.g. open-system, widely available). However, APR-DRGs may not be the best or most comprehensive risk adjustment system for every indicator.

All area indicators are risk-adjusted using age and sex, except for low-birth weight, which is not risk-adjusted. Ideally, one might like to adjust for the underlying health status of each area, but population-based measures of health status by demographic groups are not readily available.

Users should compare risk-adjusted rates with the observed rates. This will indicate the impact of risk adjustment and presumably casemix on indicator performance. Providers with large changes in performance between observed and risk-adjusted rates presumably have a more or less complex case mix.

The construction of risk-adjusted rates in the IQI module follows the method described in Greene, Econometric Analysis (2nd Ed), 1993, Section 16.4.2 on calculating fixed effects in a linear model. Two important features of this approach should be noted. First, the risk-adjusted rates are coefficients on provider or area level covariates ('fixed effects') in a linear model for each IQI that also accounts for patient demographics (age, sex, and APR DRG category). Generally, these coefficients reflect the relative performance on the IQI relative to a reference or 'omitted' group (e.g., males age 65-69). As a result, the risk-adjusted rates for each provider or area would reflect performance on the IQI for the reference group only, making interpretation and comparison with the observed raw rates problematic. Rather, the approach incorporated into running the model is to first subtract the overall IQI mean for each covariate (e.g., age category 1, age category 2, etc.) prior to running the model. The benefit of this approach is that the risk-adjusted rates (the 'fixed effects' in the model) now reflect the estimated performance on the IQI for each provider or area if that provider or area had the 'average' casemix among all providers or areas in the estimation sample.

Second, because the model is linear, rather than logistic, the estimated risk-adjusted rates may be negative (that is, the model does not require the rates to be between zero and one). This might happen, for example, if the observed rate is close to zero, and the provider or area has a more severe than average casemix. The model would predict that the provider's performance with an 'average' casemix would be less and subtract some adjusted amount from the observed rate. If that observed rate is already nearly zero, the adjusted rate may be negative. A negative rate means that the observed rate is close to zero, and that the provider or area has a less-severe-than-average casemix. In order to facilitate the interpretation of the estimates, the IQI module imposes a lower bound of zero; i.e., negative values are set to zero.

MSX smoothed rates (optional).

The IQSPSP3 and IQSPSA3 programs also yield the estimated MSX smoothed rates for each IQI. These smoothed rates are estimated using multivariate signal extraction (MSX). MSX is a smoothing technique similar to Bayesian methods. Generally, indicators defined on relatively small populations per provider or for relatively rare events are very noisy measures. In other words, many factors other than quality can influence the observed rate. For factors that we can observe, such as the patient's age or gender or APR-DRG, risk adjustment can account for their influence. There are many other clinical and non-clinical factors that we cannot observe. The MSX method estimates how much of an impact random differences in these factors across providers or areas have on the observed rate. The two SPSS programs accomplish this by adjusting toward the overall mean according to the degree of reliability of the specific provider or area indicator.

Just as risk-adjustment levels the playing field across providers and areas by "equalizing" patient and population characteristics, smoothing levels the playing field by removing random variation in the measures across providers and areas. In essence, smoothing tells us how persistent we would expect a provider's rate to be from year to year. For example, smaller hospitals with fewer cases will tend to be the best and worst performers on an indicator in a given year, because a few cases can have a tremendous impact on the rates. Compare the rates for these two hospitals:

Hospital A	**1999**	**2000**
Numerator	0	1
Denominator	11	12
Observed rate	0%	8.3%
Risk-adjusted rate	0%	8.1%
Smoothed rate	3.3%	3.5%
Hospital B		
Numerator	10	12
Denominator	363	454
Observed rate	2.8%	2.6%
Risk-adjusted rate	2.3%	2.1%
Smoothed rate	2.9%	2.8%

Looking at the observed and even the risk adjusted rates can be misleading. Quality of care in Hospital A did not necessarily decline in 2000 compared to 1999. Similarly, quality of care in Hospital A is not necessarily better than Hospital B in 1999, not is it worse than Hospital B in 2000. Notice that smoothing affects the rates for Hospital A much more than for Hospital B. In 1999, the smoothed rate is quite a bit higher than the risk adjusted rate. And in 2000, Hospital A's smoothed rate is quite a bit lower. Both smoothed rates have migrated toward the mean. On the other hand, the smoothed rate for Hospital B is much more stable across the years and it is more similar to the risk-adjusted rate. Smoothing attempts to correct for random variations by adjusting for differences in the reliability of a hospital's estimate – generally, reliability improves with a hospital's size.

The smoothed rates are intended to help you look for how best to present the data. For example, if smoothed rates vary considerably from risk-adjusted rates, you might wish to examine risk-adjusted performance by combining data for several years rather than examining a single year's performance, or just compare hospitals within peer groups. In the example, above, you might choose to present mortality rates separately by bed size and over a longer period, e.g., 3-5 years, so that cases are aggregated for smaller hospitals.

The MSX method estimates reliability in two ways: (1) a univariate "shrinkage" estimator based on the unexplained patient level variation for a single measure in a single year, and (2) a multivariate approach that looks at provider or area performance among multiple indicators and across multiple years for a single indicator. If providers or areas that perform high in one year also tend to perform high in the next, and

providers/areas that are low in one indicator tend to perform low in other related indicators, then the methods incorporate this information to improve the estimate of how much of a provider's performance on a single indicator in a single year is "signal" and how much is "noise". IQSPSP3 and IQSPSA3 report the univariate "signal" estimate, after removing the "noise".

These estimates are referred to as "smoothed" estimates because when the raw data is reported annually on a graph, for example, the line connecting the points may show massive fluctuations, seemingly with no apparent pattern. Some of these fluctuations are due to random differences in factors that influence performance, so once the impact of these factors is removed, fluctuations are reduced, or smoothed out. Improvements in performance will still be observed, however, they will only be observed when it is likely that these improvements are actually true differences, and not simply random variation.

The estimates of how related the Inpatient Quality Indicators are among measures and over time for a typical provider or area are based on estimates using the 28 states in the HCUP database. Therefore, IQSPSP3 and IQSPSA3 do not require multiple providers, measures, and years of data to operate. Instead shrinkage estimates were calculated from the combination of 28 statewide HCUP datasets to which the MSX had been applied. These shrinkage estimates are the best estimates of the impact that MSX smoothing would have on a particular IQI if MSX could be applied to the dataset being analyzed. These shrinkage estimates are then applied to the adjusted rates for each IQI, giving 'smoothed' estimates of the rates.

The smoothed estimates represent the best guess of what the provider performance would be for any given IQI if the data contained only a minimal amount of noise. This has several implications. First, users can be more certain that changes observed over time represent true differences in performance, rather than random variation. Second, in any given year, users can be more certain that the rate does not reflect only random noise. This can best be seen by comparing the smoothed estimates with the observed raw rates, which will indicate the impact of MSX on that indicator. A large impact means that the observed rate of the indicator is less precise, meaning it contains more noise relative to other indicators sustaining less impact. Low precision can result from small numbers of observations, or for relatively rare events. Therefore, the impact of the MSX estimate will in general be greater for small providers and for infrequent events. For providers with small numbers of cases, the MSX estimates may be the same over time as the estimates are being "shrunk" to an overall mean. Plotting the MSX estimates over time will reflect more persistent performance from year-to-year, and the correlations among indicators will generally be stronger.

Comparing observed, risk-adjusted and smoothed rates

The purpose of the analysis determines which rates the user should look at in evaluating the performance of a provider or an area. If the user's primary interest is to focus on a particular provider or area without any comparisons to other providers or areas, simply examine the overall observed rate for the entire provider or area, as well as further breakdowns by age, sex, payer, and race/ethnicity which are the output created by the IQSPSP2 and IQSPSA2 programs. Trend data are recommended for identifying changes over years.

If the purpose of the analysis is to compare the performance of a particular provider or area with national, state, or regional averages or performances of other selected providers or areas, then both observed and risk-adjusted rates should be examined. Variation in observed rates across providers or areas is attributable to a variety of factors including differences in patient casemix or population demographics, disparity in access to and quality of care, and other provider or area characteristics ('systematic factors'), and random factors (non-systematic factors or 'noise'). Comparing observed and risk-adjusted rates can reveal if there is any difference between the provider/area's population and the population of other providers/areas. If the difference is minimal, one can compare the observed rate with the overall average across all providers or areas. However, to account for differences in patient casemix or population demographics among different providers or areas, risk-adjusted rates should be used for provider or area-by-area comparisons.

After removing the impact of patient casemix or population demographics, if users want to examine potential existence of random factors, comparisons can be made between the risk-adjusted rates and the smoothed rates to determine if the differences in risk-adjusted rates across providers or areas are due to systematic,

as opposed to random, factors. The following two tables provide guidance on how to interpret differences in observed, risk-adjusted, and smoothed rates.

Comparing Observed Rates with Risk-adjusted Rates

Purpose: *To identify if there is any difference in the patient casemix of the provider or the demographic composition of the area relative to that of all providers or areas combined*

Observed rate **>** Risk-adjusted rate	Mortality indicators: The provider's patient population for the condition or procedure has a ***higher*** risk of mortality due to its casemix (for example, older or a greater proportion of a higher-risk APR-DRG). Utilization indicators: The provider/area's population has a ***higher*** risk of receiving the procedure due to its demographic composition (for example, older or a greater proportion of a higher-risk gender).
Observed rate **<** Risk-adjusted rate	Mortality indicators: The provider's patient population for the condition or procedure has a ***lower*** risk of mortality due to its casemix (for example, younger or a greater proportion of a lower-risk APR-DRG). Utilization indicators: The provider/area's population has a ***lower*** risk of receiving the procedure due to its demographic composition (for example, younger or a greater proportion of a lower-risk gender).
Observed rate **=** Risk-adjusted rate	Mortality indicators: The provider's patient casemix for the condition or procedure is similar to other providers', suggesting that patient composition is not a contributing factor to the provider's performance for the mortality indicator. Utilization indicators: The provider/area's population is similar to other providers/areas' in demographic composition.

Comparing Risk-adjusted Rates with Smoothed Rates (optional)

Purpose: *To determine if differences in risk-adjusted rates across providers or areas are due to systematic or random factors after patient casemix or demographic composition is taken into account.*

Risk-adjusted rate ***close to*** Smoothed rate	The provider/area's risk-adjusted rate is more precise, an accurate reflection of the provider/area's systematic ('true') rate. If there is any difference between the risk-adjusted rate and the overall area average[1], such difference is likely to be due to systematic factors.
Risk-adjusted rate ***different from*** Smoothed rate	The provider/area's risk-adjusted rate is less precise[2]; that is, some of the difference between the risk-adjusted rate and the overall area average is due to random ('noise') factors. The smoothed rate is thus a more accurate estimate of the systematic rate than the risk-adjusted rate. Comparing the smoothed rate to the overall provider/area average reveals more accurately the 'true' performance of the provider or area.

Notes: 1. The overall provider or area average refers to the weighted average risk-adjusted rates across all providers or areas.
2. The risk-adjusted rates for providers or areas with small population are generally less precise.

Generally, subtracting the observed, risk-adjusted and smoothed rates can help to reveal differences among these rates. To get a sense of the magnitude, the most straightforward approach is to estimate the difference in terms of the number of cases in the numerator. For example, for a hospital with 1000 CABG cases, a difference of -0.005 between the observed rate and risk-adjusted rate would mean five deaths. Whether the difference between rates is statistically meaningful will depend on the number of discharges in the population at risk, and the sampling variability for each indicator. Users can apply a rough rule of thumb to estimate the required difference: 1.4* SQRT(p*(1-p)/N), where p is the rate and N is the denominator of the indicator.

For example, if the observed rate for an indicator is p=0.045 and the population at risk is N=200, applying the formula to these numbers will produce: 1.4* SQRT(0.045*(1-.045)/200) = 0.0205. That is, for the risk-adjusted rate to be significantly different from the observed rate, the absolute difference between the two rates has to be equal to or greater than 0.0205.

Benchmark timings

The benchmark runtimes given below are from runs made on a Microsoft Windows 98 PC, with an Intel P3, 500 MHZ processor, and 256MB of RAM. The dataset used contained 500,494 observations with 15 diagnosis fields and 15 procedure fields.

Step	Run time (in minutes)
Run IQSPS1	3
Run IQSPSP2	2
Run IQSPSP3	3
Run IQSPSA2	1
Run IQSPSA3	2

User Support

We would like to receive your feedback on the AHRQ Quality Indicators.

Our Internet address for user feedback is: support@qualityindicators.ahrq.gov